Some reasons why capital does not flow from rich to poor countries

Hildegunn Kyvik Nordås

WP 1997: 18

Working Paper
Chr. Michelsen Institute
Development Studies and Human Rights
Bergen Norway

ISSN 0804-3639

Some reasons why capital does not flow from rich to poor countries

Hildegunn Kyvik Nordås

WP 1997: 18

Bergen, November 1997

CHR. MICHELSEN INSTITUTE
Development Studies and Human Rights

Working Paper WP 1997: 18

Some reasons why capital does not flow from rich to poor countries

Hildegunn Kyvik Nordås

Bergen, December 1997

Summary:
This paper introduces endogenous adoption costs for productive assets in a Ramsey type growth model with international capital flows. There are two classes of productive assets: owner-specific and location-specific. Adoption costs are an increasing function of the level of technology embodied in the investor's owner-specific assets and a declining function of the host country's location-specific assets. In this setting the return to capital is low in capital-poor countries. Consequently, they receive small amounts of foreign investments. Further, even though capital flows from North are spread evenly across industries in the South, the relative importance of high-technology industries is small in terms of output.

Indexing terms:

International capital flows
Economic growth
Industrial structure

Stikkord:

To be ordered from Chr. Michelsen Institute, Fantoftvegen 38, N-5036 Fantoft, Bergen, Norway. Telephone: +47 55574000. Telefax: +47 55574166

1. Introduction

Capital does flow from rich to poor countries, but both stocks and flows are highly concentrated in a few newly industrialized countries. This investment pattern seems to be at odds with the neoclassical growth model which exhibits diminishing returns to capital. It predicts that the return to capital is highest in relatively capital-poor countries, and as a consequence, capital should flow from rich to poor countries if it is internationally mobile. However, empirical evidence suggests that the rate of return to capital is not higher in capital-poor than in capital-rich countries (World Bank 1989, Bardhan 1996). This finding has induced a shift in research emphasis from imperfections in the international capital markets to analyses of what determines the rate of return to capital, usually in the context of endogenous growth models.

There are two main strands of endogenous growth models which are concerned with the low rate of return to capital in relatively capital-poor countries. Both concentrate on foreign direct investment (FDI), and both explain the coexistence of relative capital scarcity and low returns to capital by the complementarity between internationally mobile capital and another factor of production which is not internationally mobile. The first strand argues that the immobile, complementary factor of production is human capital (Uzawa 1965, Lucas 1988; 1990; 1993, Fafchamps 1995, Barro, Mankiw and Sala-i-Martin 1995, Stokey 1996). Poor countries are assumed to be in relatively short supply of human capital, and relatively meager flows of FDI follow.

The second strand argues that intermediate goods and services are non-tradable and complementary to capital. In this literature, productivity is determined by the degree of specialization, which in turn is determined by the extent of the market. Since small or poor countries have small markets, the degree of specialization is shallow, and the return to the primary factors of production is low as a consequence (Faini 1984, Rodriguez-Clare 1996). There is, however, little empirical evidence that intermediate goods and services are non-tradable. To the contrary, they constitute a significant and increasing share of world trade (United Nations 1996). Moreover, small countries tend to have a similar input-output structure as larger countries, but the import share of intermediate goods and services is higher (Chenery et. al. 1986).

In this paper we return to imperfections in the international capital markets and combine them with complementarities between different types of capital. Thus, we adopt the idea from the first strand of research that there are two complementary types of capital, one more internationally mobile than the other. However, our model differs from the first strand in four important ways: First, while previous papers typically assume that factors are either perfectly mobile between countries or they do not move across international boundaries at all, we wish to analyze the more general case with imperfect international capital markets. Thus, our model has the property that international movements of capital are limited by transaction costs without eliminating capital movements altogether.

Second, we reinterpret the two types of capital to represent owner-specific and location-specific capital. In this respect, we build on insights from industrial organization-based theories of FDI. This literature sees FDI as a strategic decision by individual companies on where to locate value-adding activities. Such decisions are driven by the urge to find the most efficient way of combining the firm's owner-specific assets with the host country's location-specific assets for each value-adding activity (Dunning 1993, United Nations 1996).[1] This behavior translates into a maximization problem which is the micro-foundation for the model developed in this paper. Through this reinterpretation we are able to focus sharply on the mobility-dimension. In our context, human capital may well be owner-specific and internationally mobile, while physical capital assets may be internationally immobile. In addition, we are able to include some intangible assets such as the rule of law and other social infrastructure among the location-specific assets.

Third, as a consequence of our reinterpretation of the two types of capital, we maintain labor as a separate factor of production. This is necessary because human capital is usually, explicitly or implicitly, assumed to be embodied in workers, who in turn may absorb an unlimited amount of it. This is not an appropriate feature of location-specific capital. Labor is therefore included and assumed to be in fixed supply. As a consequence, our model does not generate endogenous growth unless there are positive externalities related to location-specific capital accumulation. In contrast, a Cobb-Douglas combination of two types of capital goods only, yields endogenous growth even in the absence of externalities.

Finally, our model differs from former models regarding the nature of externalities related to location-specific capital accumulation. The externality in our model reduces

[1] Even when location specific assets are combined with firm-specific assets of foreign companies, this does not necessarily result in FDI. Alternative arrangements are joint ventures, licensing or simply selling owner-specific assets to foreign firms. See Markusen (1995) for an overview.

the adoption cost of owner-specific capital. The existence of such adoption costs is indicated in several studies. De Long and Summers (1991) find that the real relative cost of capital goods seems to be particularly high in developing countries, while recent estimates of the wealth of nations suggest that the distribution of owner-specific assets among countries is more uneven than the distribution of location-specific assets (Dixon and Hamilton 1996). The latter result is incompatible with perfectly mobile owner-specific assets. We argue that it is reasonable to assume that adoption costs increase with the degree of sophistication of the value adding activity in which investment is made, and decline with the stock of location-specific assets in the host country, hence the externality. By combining adoption costs and differentiated owner-specific assets, we are able to analyze both the amount and the composition of FDI flowing to the South.

We show that in this setting, the observed international capital flows are consistent with the neoclassical growth model. Further, our model predicts that FDI is distributed equally among different types of value added activities, but the stock of capital which ends up as an input in the production process is smaller the more technologically sophisticated the activity for a given level of location-specific capital. Thus, the model is consistent with the observation that even the poorest countries of the world are linked to the Internet and use cell-phones, although the relative price of such services are very high. The next section of the paper presents the model, while section 3 draws some policy implications and section 4 concludes.

2. The model

A Ramsey-type growth model with two types of accumulated assets is developed. The two types of assets are owner-specific, denoted *K,* and location-specific, denoted *H.* Factor income can be spent on consumer goods or saved, while savings are invested in *H* or *K*, the latter at home or abroad. A world with a fixed common stock of technology in the form of *n* blueprints is presupposed. Each blueprint represents a technology which firms may transform into owner-specific assets. Such assets are ranked according to the amount of technology embodied in them. The aggregate stock of *K* in the economy is therefore given by:

$$K = \sum_{i}^{n} \lambda^{i} k_{i} \qquad (1)$$

and is the sum of technology-adjusted assets defined by a quantity parameter k_i and a quality parameter, λ^i, $\lambda > 1$. A cost of transforming each blueprint into productive assets is incurred by firms and increases with the level of sophistication of the technology. Next, the owner-specific assets are adopted to the location-specific assets in a particular country. The cost of doing so is assumed to decline with the stock of location-specific assets available to the investing firm. The cost function then reads:

$$c_i = \tau \frac{\lambda^i}{H} \qquad (2)$$

This formulation has an empirical foundation: The log of initial GDP times the stock of human capital is usually included in growth regressions in order to capture the interaction between GDP and human capital. It is assumed that a higher level of human capital raises the ability to absorb new technologies and therefore speeds up the convergence process. As expected, the interaction variable is found to be inversely related to real growth (Barro and Sala-i-Martin 1995). Equation (2) captures this empirical relationship by introducing adoption costs proportional to the complexity of the production process, and inversely proportional to the accumulated stock of location-specific assets. As a consequence of (2) and the fact that countries have different endowments of location-specific assets, adoption costs differ among countries. Adoption costs are assumed to be of the iceberg type which means that one unit of savings is transformed to $1/c_i < 1$ units of owner-specific assets of quality i. The stock of effective capital of quality i employed in the economy is therefore given by:

$$\hat{k}_i = k_i / c_i \qquad (3)$$

From (1) the differentiated asset has more in common with quality ladder models as developed by Grossman and Helpman (1991) than with vintage models of capital, although the quality ladder input in our model is indeed capital. Production of final goods is assumed to be perfectly competitive. Therefore, all producers of final output can be aggregated into one macro production function, assumed to be of the usual Cobb-Douglas type:

$$Y = AL^{1-\alpha-\gamma} H^{\gamma} \sum \left(\lambda^{i} \hat{k}_{i} \right)^{\alpha} \quad (4)$$

or using (1) and (3):

$$Y = \overline{A} L^{1-\alpha-\gamma} H^{\alpha+\gamma} \sum k_{i}^{\alpha} \quad (4')$$

where Y is total output, or factor income, A is a constant defining the unit of measurement, $\overline{A} = A / \tau^{\alpha}$ and L is labor, which is assumed to be in fixed supply. With this specification, varieties of the owner-specific assets are not direct substitutes or complements to each other. Note that the production function exhibits constant returns to scale in labor, location-specific capital and efficient owner-specific capital (4), but exhibits increasing returns to scale in labor, location-specific capital and nominal owner-specific capital when the externality is taken into account (4'). Note also that when adoption costs are taken into account, the quality parameter is eliminated and the model reduces from a quality ladder model to a model of expanding variety. Factor income is consumed or saved according to consumers' utility maximization problem. Infinitely lived households maximize the standard constant intertemporal elasticity of substitution utility function:

$$u(c) = \int_{t}^{\infty} \frac{c^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt \quad (5)$$

where c is consumption per capita, ρ is the time preference rate and θ is the elasticity of marginal utility.[2] The flow household budget constraint reads:

[2] Lower case letters represent per capita figures.

$$\dot{h}+\sigma\dot{k}+\dot{\sigma}k=r_h h+r\sigma k+w-c \tag{6}$$

where σ is the share of owner-specific assets owned by domestic citizens and r is the exogenous world market interest rate. Whenever $r_h > r$, all domestic savings will be invested in location-specific assets, and $\sigma = 0$. When $r_h = r$ on the other hand, investors are indifferent whether to invest in location-specific assets or owner-specific assets at home or abroad. In order to keep the focus sharp, let us concentrate on developing countries for which the constraint on capital movements imposed by the stock of H is binding such that $\sigma = 0$. New types of owner-specific assets are always introduced by foreign investors in such countries and the solution to the standard Ramsey growth model yields the Euler equation:

$$\frac{\dot{C}}{C}=\frac{1}{\theta}\left(r_h-\rho\right) \tag{7}$$

Owner-specific assets of all qualities earn the world market rate of interest, r, in all countries. The stock of quality i employed in the economy is thus determined by the condition that its marginal product equals the world market interest rate, which, applying (2) and (4) yields:

$$k_i=\left[\alpha\bar{A}L^{1-\alpha-\gamma}H^{\alpha+\gamma}\,/\,(r+\delta)\right]^{1/(1-\alpha)} \tag{8}$$

where δ is the depreciation rate of owner-specific assets. Note that the "nominal" stock is independent of the quality parameter λ^i. Therefore, the amount of savings invested in each and every quality rung of owner-specific assets is the same. Moreover, this implies that there is only one state variable related to the investment in owner-specific assets, namely the total stock of k.[3] The efficient stock, e.g. the stock adjusted for adoption costs, however, is smaller the more technologically sophisticated the asset and the smaller the stock of location-specific assets in the economy. Applying (3) and (4), it turns out that the marginal product of the nominal and efficient stock of each rung of owner-specific assets are related as follows:

$$MP\hat{k}_i = MPk_i c_i^{\alpha/(1-\alpha)} = (r+\delta)c_i^{\alpha/(1-\alpha)} \qquad (9)$$

The rate of return to the efficient capital stock is thus above the world market interest rate in capital-poor countries. Condition (9) reconciles the extended neoclassical model with the observation that the return to "nominal" capital does not differ much between countries in spite of the fact that developing countries are relatively poor in capital. In other worlds, the return to savings are not higher in capital-poor countries, but the returns to installed, productive capital is higher, as predicted by the neoclassical growth model. Since it is the rate of return to savings that matters to the international investor, capital does not flow from rich to poor countries to the extent predicted by the simplest version of the neoclassical growth model.

[3] The majority of authors working with growth models with differentiated inputs take such inputs to be *intermediate* goods and services. This is done in order to focus on the issue at stake while avoiding the complexity of an additional state variable that a differentiated capital input would involve. The additional state variable would be the number of horizontally or vertically differentiated capital goods. In this paper the additional state variable is eliminated by the cost function, which is not entirely unrealistic.

Our model can be read as a reduced form model of a multi-good economy in which consumers have homothetic preferences (see Stokey 1996). Understood in this way, equation (8) together with (3) can be interpreted to predict that the smaller the stock of location-specific assets in a country, the smaller the flow of FDI, and the smaller the share of high-technology industries in total output. Finally, note that in steady state when $r_h = r$, savings will be allocated among the two kinds of assets such that $H / nk = \gamma / \alpha$, and the production function can be expressed as a function of location-specific assets only, when the labor force and the number of blueprints are given: $Y = \tilde{A} H^{2\alpha+\gamma}$ where $\tilde{A} = A L^{1-\alpha-\gamma} n^{1-\alpha} (\alpha / \gamma\tau)^{\alpha}$. It is, thus, accumulation of location-specific assets that drives the model.

The foreign investor takes the stock of location-specific assets as given, while local investors in location-specific assets do not take into account the impact on adoption costs when they take the investment decision. Hence (2) introduces an externality related to investment into the model. The externality implies that the decentralized market solution to the Ramsey model is not the social optimum, and there is room for policy measures to improve welfare. The market solution to the Ramsey problem is found by substituting the equilibrium condition that the value of the marginal product of location-specific assets, disregarding the externality, equals the interest rate into the Euler equation. Using (4) and (8) this yields:

$$\frac{\dot{C}}{C} = \frac{1}{\theta}\left(\gamma \bar{A} L^{1-\alpha-\gamma} H^{\alpha+\gamma-1} n k^{\alpha} - \delta - \rho\right) \qquad (10)$$

where the depreciation rate is assumed to be the same for both types of capital. It is well known that when the savings rate as well as the world market interest rate are constant over time, both output and the stock of location-specific capital grow in tandem with consumption. (10) then represents the growth rate of output as well. The social planner takes the externality into account. Her optimal level of investment in location-specific assets is thus given by the condition that the value of the marginal product of H in equation (4') equals the interest rate. Inserting this into the Euler equation yields:

$$\frac{\dot{C}}{C} = \frac{1}{\theta}\left((\alpha+\gamma)\bar{A}L^{1-\alpha-\gamma}H^{\alpha+\gamma-1}nk^{\alpha} - \delta - \rho\right) \tag{11}$$

The social optimum growth rate of consumption given by (11) is clearly higher than the market solution, since $\alpha + \gamma > \alpha$. Hence, it is apparent that the externality leads to under-investment in location-specific assets. We therefore turn to policy measures to achieve the social optimum.

3. Policy implications

The obvious policy implication derived from comparing (10) and (11) is to introduce a subsidy on investment in location-specific assets at a rate $s_h = (\alpha+\gamma)/\lambda$. Alternatively, a subsidy rate of $s_k = ((\alpha+\gamma)/\gamma)^{(1-\alpha)/\alpha}$ on foreign investment would have the same effect.[4] Whenever $\alpha < 1/2$, $s_h < s_k$. Empirical findings (Mankiw Romer

[4] The subsidy rate is found by substituting (8) into (10) and (11) and compare the results.

and Weil 1992) suggest that this is the case. When the relative share of H in production is sufficiently small (see the appendix), the subsidy per unit of output is smallest when levied on location-specific assets. In that case, the optimal growth path can be attained at the lowest budgetary outlay by subsidizing location-specific assets. From this it can be concluded that if government takes care of location-specific assets, either through subsidizing private investment in such assets or through government investment, owner specific asset flows will take care of itself. Government investment in location-specific assets beyond the point where $H/nk = \gamma/\alpha$ would, however, be inefficient. Finally it should be stressed that since the model is highly stylized and captures only a few aspects of reality, policy implications are only suggestive.

4. Summary and conclusions

Lucas (1990) raised the question why capital does not flow from rich to poor countries and suggested that the reason has to do with a low stock of human capital and the existence of local externalities from investment in human capital. In a more recent paper (Lucas 1993), he emphasizes the implication that the main engine of growth is accumulation of human capital, while physical capital is essential but plays a subsidiary role.

This paper supports Lucas' conclusions, reinterpreted to location and owner-specific capital. In addition, we argue that (iceberg) adoption costs to owner-specific assets further reduce the return to both owner-specific and location-specific capital. These costs pose a wedge between the amount of savings utilized by the investor and the efficient stock of assets employed in the production process. In our model, therefore, the rate of return to owner-specific capital is not only depressed by a small stock of complementary location-specific assets, the return to the latter is also depressed by high adoption-costs to owner-specific assets.

We introduce a new dimension to the model by differentiating owner-specific assets according to the amount of technology embodied in them If the array of ascending quality parameters is interpreted as increasingly technologically sophisticated industries, the model predicts precisely the industrial structure found in poor countries: The industrial base is narrow and the share of high-technology industries and services is small, but usually not zero, with high relative prices of high-tech goods and services. Finally, our specification of the cost and externality structure allows us to deal with differentiated capital goods without the complication of an additional state variable.

Appendix

Subsidies on H and K per unit of output are determined by the first order condition from the profit-maximization problem. Using (1) and (3) this yields:

$$H = \frac{\gamma}{r_h + \delta} Y \quad \text{and} \quad nk = \frac{\alpha}{r + \delta} Y \qquad \text{A1}$$

The optimal subsidy rate per unit of output for the two types of assets are therefore:

$$s_{hy} = \frac{\alpha+\gamma}{r_h+\delta} \quad \text{and} \quad s_{ky} = \frac{\alpha}{r+\delta}\left(\frac{\alpha+\gamma}{\gamma}\right)^{\frac{1-\alpha}{\alpha}} \qquad \text{A2}$$

It remains to show under which conditions $s_{hy} < s_{ky}$. Rearranging A2 we find that the inequality holds when:

$$1+\frac{\gamma}{\alpha} < \frac{r_h+\delta}{r+\delta}\left(1+\frac{\alpha}{\gamma}\right)^{\frac{1-\alpha}{\alpha}} \qquad \text{A3}$$

which is fulfilled for reasonable parameter values.

Acknowledgments

I am grateful to Kjell-Erik Lommerud and Trond Olsen for useful comments.

References:

Bardhan, P., 1996, "Disparity in wages but not in returns to capital between rich and poor countries," *Journal of Development Economics*, vol. 49, no. 2, pp.257-270.

Barro, R. J., N. G. Mankiw and X. Sala-i-Martin, 1995, "Capital mobility in neoclassical models of economic growth", *The American Economic Review,* vol. 85, no. 1, pp. 103-115.

Barro, R. J. and X. Sala-i-Martin, 1995, *Economic Growth,* New York: McGraw Hill.

Chenery, H., S. Robinson and M. Syrquin, 1986, *Industrialization and Growth. A Comparative Study,* A World Bank Research Publication, Oxford: Oxford University Press.

De Long, J. B. and L. H. Summers, 1991, "Equipment investment and economic growth", *The Quarterly Journal of Economics*, vol.106, no.2, pp. 445-502.

Dixon, J.A. and K. Hamilton, 1996, "Expanding the Measure of Wealth," Finance and Development, December, pp.15-18.

Dunning, J.H., 1993, *Multinational Enterprises and the Global Economy,* Wokingham, England: Addison-Wesley Publishing Company.

Fafchamps, M, 1995, "Mobile capital, local externalities and economic development," Mimeo, Stanford University.

Faini, R., 1984, "Increasing returns, non-traded inputs and regional development," *The Economic Journal,* 94, June, pp. 308-323.

Grossman, M.G. and E. Helpman, 1991, *Innovation and Growth in the Global Economy,* Cambridge, Mass.: MIT Press.

Horstmann, I.J and Markusen, J.R., 1992, "Endogenous market structures in international trade," *Journal of International Economics,* vol 32, no 1, pp. 109-129.

Lucas, Robert E. Jr., 1988, "On the mechanics of economic development", *Journal of Monetary Economics*, vol. 22, no 1, pp. 3-42.

Lucas, Robert E. Jr., 1990, "Why doesn't capital flow from rich to poor countries?" *American Economic Review*, Papers and Proceedings, May, pp. 92-96.

Lucas, Robert E. Jr., 1993, "Making a miracle". *Econometrica*, vol. 61, no.2, pp. 251-272.

Mankiw, N. G., D. Romer and D. N. Weil, 1992, "A contribution to the empirics of economic growth", *The Quarterly Journal of Economics*, vol. 107, no. 2, pp 407-437.

Markusen, J.R., 1995, "The boundaries of multinational enterprises and the theory of international trade," *Journal of Economic Perspectives,* vol. 9, no. 2, pp 169-189.

Rodriguez-Clare, A., 1996, "The division of labor and economic development", *Journal of Development Economics,* vol. 49, pp. 3-32.

Stokey, N. L., 1996, "Free trade, factor returns and factor accumulation," *Journal of Economic Growth,* vol. 1, no. 4, pp. 421-447.

United Nations, 1996, World Investment Report 1996. Investment, trade and international policy arrangements, New York: United Nations.

Uzawa, H., 1965, "Optimal technical change in an aggregate model of economic growth," *International Economic Review,* vol. 6, no. 1, pp.1-24.

World Bank, 1989, World Development Report 1989, New York: Oxford University Press.

Recent Working Papers

WP1997: 1 SUMAILA, Rashid Ussif
Strategic dynamic interaction: The case of Barents Sea fisheries. Bergen, January 1997.

WP 1997: 2 BØE, Turid
Share-tenancy within the household unit. Bergen, February 1997, 27 pp.

WP 1997: 3 BØE, Turid
Evolutionary game theory and the battle of the sexes. Bergen, March 1997, 16 pp.

WP 1997: 4 BØE, Turid
Teoriskapt virkelighet? Ny-klassisk teori og kvinnelige økonomiske aktører. Bergen, mars 1997, 17 s.

WP 1997: 5 NORDÅS, Hildegunn Kyvik
Terms of trade and economic growth in a world of constrained capital mobility. Bergen, March 1997, 25 pp.

WP 1997: 6 ANGELSEN, Arild
The evolution of private property rights in traditional agriculture: Theories and a study from Indonesia. Bergen, April 1997, 40 pp.

WP 1997: 7 ANGELSEN, Arild
State - local community games of forest land appropriation. Bergen, April 1997, 32 pp.

WP 1997: 8 PAUSEWANG, Siegfried
Can national identity be built on local democracy? Bergen, May 1997, 16 pp.

WP 1997: 9 SUMAILA, Ussif Rashid
A review of game theoretic models of fishing. Bergen, June 1997, 19 pp.

WP 1997: 10 MOORSOM, Richard
Underdevelopment and labour migration: the contract labour system in Namibia. Bergen, June 1997. 83 pp

WP 1997: 11 SUMAILA, Ussif Rashid
Fish as vehicle for economic development in post-independent Namibia. Bergen, July 1997, 31 pp.

WP 1997: 12 WIIG, Arne
Microcredit programmes: Methods for solving dilemmas of credit expansion. Bergen, August 1997.

WP 1997: 13 NORDÅS, HIldegunn Kyvik
Economic development and industrial structure - an overview. Bergen, September 1997, 27 pp.

WP 1997: 14 WIIG, Arne
Strategisk handelsteori og økonomisk utvikling. Bergen, september 1997, 18 s.

WP 1997: 15 MARQUETTE, Catherine
Population and environment relationships in developing countries: A select review of approaches and methods. Bergen, October 1997, 15 pp.

WP 1997: 16 MARQUETTE, Catherine
Turning but not toppling Malthus: Boserupian theory on population and the environment relationships. Bergen, October 1997, 15 pp.

WP 1997: 17 KNUDSEN, Are
Mountain protected ateas in Northern Pakistan: the case of Khunjerab National Park. Bergen, December, 1997, 23 pp.